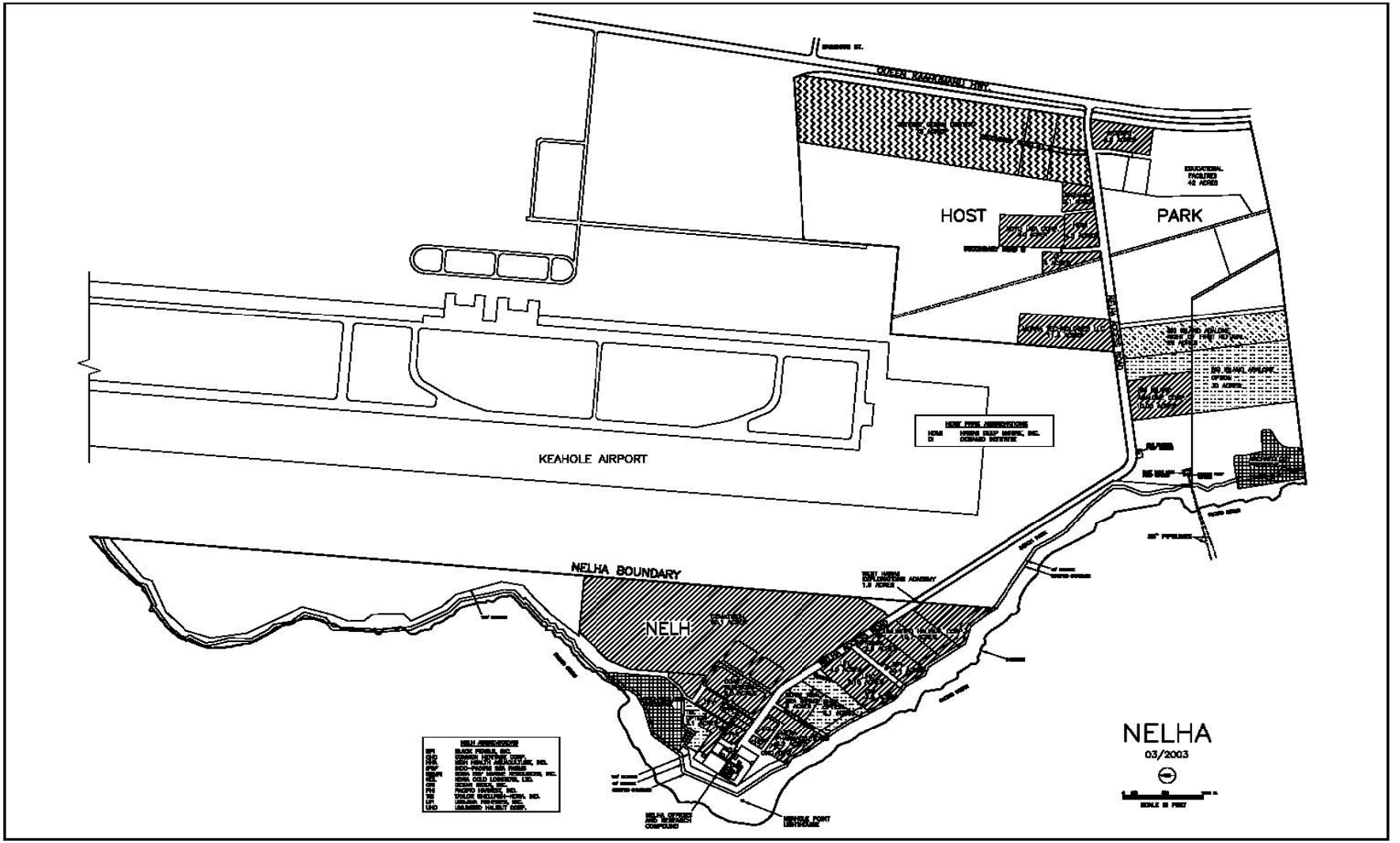
# The Distributed Energy Revolution: The Implications for Hawai`I and the role of the NELHA Gateway DER Center

## Natural Energy Laboratory of Hawaii Authority [NELHA]

**Administered by the Department of Business, Economic Development & Tourism**
**State of Hawaii**


STATE OF HAWAII
NATURAL ENERGY LABORATORY
OF HAWAII AUTHORITY
KEAHOLE POINT


QUEEN KAAHUMANU HWY.
HOST
PARK
KEAHOLE AIRPORT
NELHA BOUNDARY
NELHA
NELHA
03/2003

# History of NELHA

# Natural Energy Laboratory of Hawaii Authority [NELHA]

## Natural Energy Laboratory of Hawaii (NELH)

- Established by Hawaii State Legislature in 1974 as a research support facility for the development of alternate energy & related technologies.
- Offshore studies begun in 1976.
- Mini-OTEC launched in 1979.
- Initially administered by the Research Corporation of the University of Hawaii (RCUH).

## Hawaii Ocean Science & Technology [HOST] Park

- Established by Legislature in 1985 to allow commercial expansion of the activities spawned by NELH research.
- Initially administered by the High Technology Development Corporation [HTDC].
- Legislated to be administered with NELH by the Natural Energy Laboratory of Hawaii Authority [NELHA] in 1990.

# NELHA

The Natural Energy Laboratory of Hawaii Authority [NELHA] was created by the Hawaii State Legislature in 1990 to administer both the 322-acre Natural Energy Laboratory of Hawaii [NELH] and 548-acre Hawaii Ocean Science & Technology [HOST] Park properties located at Keahole Point on the Island of Hawaii.

# NELHA Board of Directors

11 Voting Members:

- Dept of Business, Economic Development and Tourism (Director)
- University of Hawaii (President)
- Board of Land & Natural Resources (Chairman)
- County of Hawaii ( Mayor)
- Research Advisory Committee (2)
- Governor Appointees (3)
- Hawaii Strategic Development Corporation *
- High Technology Development Corporation *

1 Tenant (Non-Voting) Representative

# NELHA Mission Statement

"To develop and diversify the Hawaii economy by providing resources and facilities for energy and ocean-related research, education, and commercial activities in an environmentally sound and culturally sensitive manner"

# NELHA
# Outstanding Resources

A unique complement of natural and logistical resources at Keahole Point gives NELHA a decided advantage over other locations.

# LOCATION & STABILITY


- NELHA's PROXIMITY to an INTERNATIONAL AIRPORT allows import and export activities as well as, travel, to be conducted with relative ease.
- LOCATION within a STABLE POLITICAL CLIMATE is a plus for any business venture weighing options at sites around the world. Other places in the equatorial regions where warm and cold seawater might also be accessible tend to be in politically unstable settings in developing countries..

# SUNSHINE AND LOCATION

- **SOLAR INSOLATION** is consistently high at NELHA, with the rate of incoming natural sunshine ranked above that of any other coastal site in the United States. Rainfall is also low, less than 15 inches per year, maximizing days of clear, cloudless skies.
- **NELHA's LOCATION** at Keahole Point is an ideal setting for an ocean science facility primarily due to its steep offshore bathymetry and narrow band of coral reef, characteristic of the geologically youthful Big Island. The steep bathymetry affords close proximity to deep ocean water, accessed within one mile from shore at Keahole Point. Contrast this to geologically older locations such as islands with more extensively developed reef systems or continental coasts where access to deep ocean water may typically be 50-100 miles from shore.

# SEA WATER

Access to both warm surface and cold deep seawater in large quantities in one location, is not available anywhere else as ideal as at Keahole in Kailua-Kona.

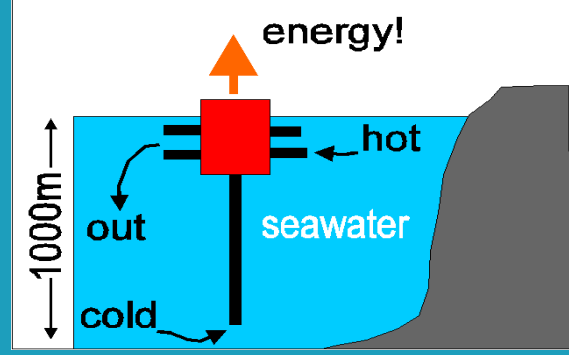
# WARM SURFACE SEA WATER

WARM SURFACE SEAWATER (SSW) is pumped onshore continuously, drawing from an inlet pipe located 600 feet offshore at a depth of 45 feet from the surface and 45 feet above the ocean bottom. The waters from the NELHA SSW is drawn are rated Class AA in water quality and range in temperature from 76° to 82° F (24.5° to 27.5° C) year round.

# COLD DEEP SEAWATER

COLD DEEP SEAWATER (DSW) is pumped continuously from 2,000 foot depths and is distributed onshore through the largest seawater delivery system of its kind. The DSW is drawn from chilly deep ocean water less than one mile from shore at a constant 43° F (6° C), virtually pathogen-free and rich in the organic nutrients essential for plant growth.

# Ocean Thermal Energy Conversion (OTEC)




THE LARGE TEMPERATURE DIFFERENCE BETWEEN SSW AND DSW brought onshore makes NELHA ideal for technologies such as ocean thermal energy conversion (OTEC). Hawaii is one of the few locations in the developed world that is included in the broad band of oceanic waters in which these conditions exist, circling the globe within about 23 degrees latitude to the north and south of the equator. NELHA is recognized internationally for pioneering work on the concept of OTEC .

# NELHA
# Pioneer in OTEC Technology

In 1979, a barge dubbed "Mini-OTEC," anchored offshore of Keahole Point, demonstrated the world€s first production of net electrical power via closed-cycle OTEC.

# NELHA
# Pioneer in OTEC Technology

In 1981, shore-based OTEC research began with a project testing biofouling and corrosion countermeasures for the closed cycle OTEC process.

# NELHA
# Pioneer in OTEC Technology

# NELHA
# Today and Tomorrow


# Colder and Deeper Seawater 3,000 Ft Depths

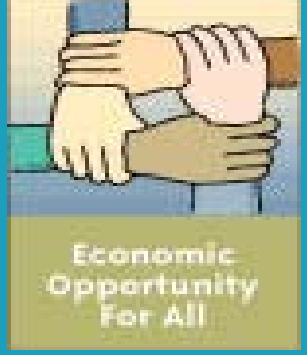
- Soon NELHA will also be pumping cold seawater from 3,000 ft depths via 55” pipelines deployed in 2001.
- Water from this depth will maintain a constant 39°F (4° C).
- Construction of the onshore distribution for this pipeline will be starting in early summer and be completed by the end of 2003.
- Several companies have invested millions of dollars in infrastructure and are developing commercial activities that will boost revenues for NELHA and the State of Hawaii.

# Colder and Deeper Seawater 55” Pipelines


# NELHA Tenants

## Thirty (30) tenants

- Aquaculture (Abalone, Moi, Flounder, Lobster, Crab, Shrimp)
- Education
- Neutraceuticals (Spirulina, Astaxanthin)
- Water (Boutique Beverages)
- Cosmetics
- Salt




# NELHA
# Diversifying & Strengthening Hawaii's Economy

- $ 2 million revenues/annum
- $32 million multipliers
  - Taxes
  - Jobs
  - Spending
- $50 million infrastructure

# The NELHA Gateway

- A signature project to be located at the entrance to the Hawaii Ocean Science & Technology (HOST) Park of the Natural Energy Laboratory of Hawaii.
- A campus setting for research, development, education and outreach.
- Three primary thrust areas:
  - Distributed and Renewable Energy Resources
  - Ocean Sciences and Marine Bioproducts
  - Education, Outreach, and Eco/Techno Tourism
    - Related Commercial Activities

# Phase I: NELHA Gateway Distributed Energy Resources (DER) Center

*The NELHA Gateway DER Center provides the foundation for a premier national institute dedicated to the development, testing, and deployment of distributed energy generation technologies.*

# Phase I: NELHA Gateway Distributed Energy Resources (DER) Center

- Construction grant used to design and build a state-of-the-art facility and infrastructure.
- Center will serve as incubator for companies focused on renewable/distributed energy generation.
- Establishment of industry partnerships through co-sponsored Research, Development, Demonstration & Deployment is a key program element.
- National partners will advance market penetration overseas (to bridge US technology with Asia-Pacific needs)

# Federal Funding

- Construction Funds
  - 1999 $ 1.0 million
  - 2000 $ 1.5 million
  - 2001 $ 0.5 million
  - 2002 $ 0.5 million
- Program Funds
  - 2002 $ 0.5 million
- TOTAL 1999-2002 $ 4.0 million

# Federal Funding
# Fiscal Year 2003

- Congress has appropriated an additional $1 million through the U.S. Department of Energy to continue support of the NELHA Gateway DER Center and energy programs.

- TOTAL 1999 – 2003 $ 5.0 million

# The Big Island of Hawaii Ideal Location for the NELHA Gateway DER Center

- Urgent need for distributed energy resources (DER).
- A model demonstration site to less developed energy economies without difficulty of working outside the United States.
- Proximity of potential markets in Asia-Pacific region.
- Existing and planned DER (private and public sector) projects afford partnering opportunities to maximize resources and enhance knowledge base.
- Existing renewable energy resources, hybrid energy projects, and community support offer opportunity for Hawaii to lead the nation as a model for research, development and demonstration of DER projects.

# Big Island Energy Picture

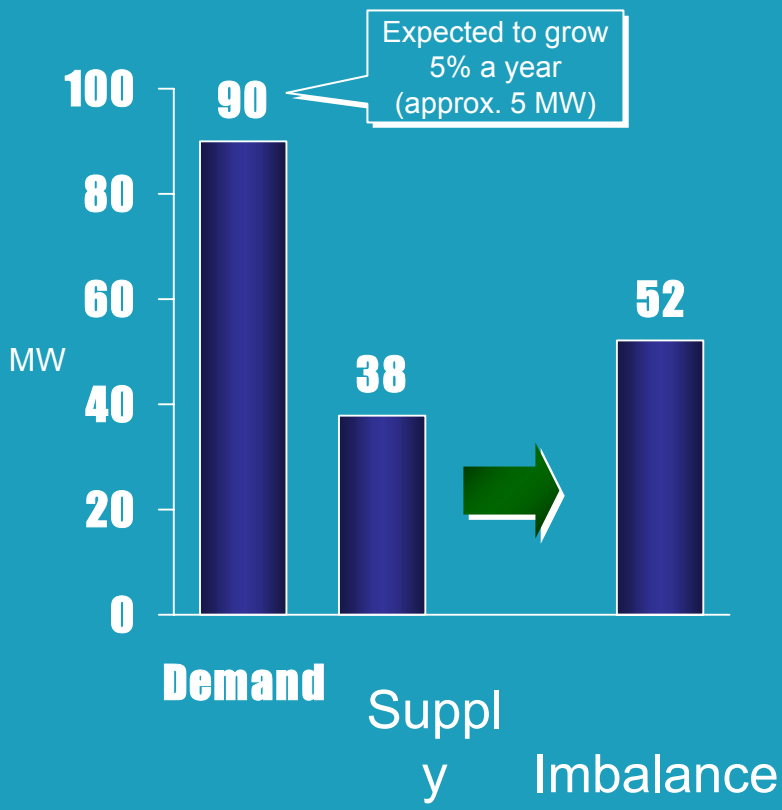
- Small isolated grid (175MW)
- Wide array of existing renewable technologies and resources
  - $70^{+}$ MW developed or permitted
  - Existing solar, wind, hydroelectric and geothermal generation
  - Significant biomass and ocean thermal resources
- High average energy cost ($0.20/kw-hr, $2.50 per gallon gasoline)
- Unique transmission and demand characteristics
  - Daytime peak strains transmission system
  - Lower night demand requires curtailment of RE sources
  - Off-peak cost-effective RE is available for conversion into hydrogen and application in DG systems
- Major energy users have announced and implemented plans to disconnect from the grid.

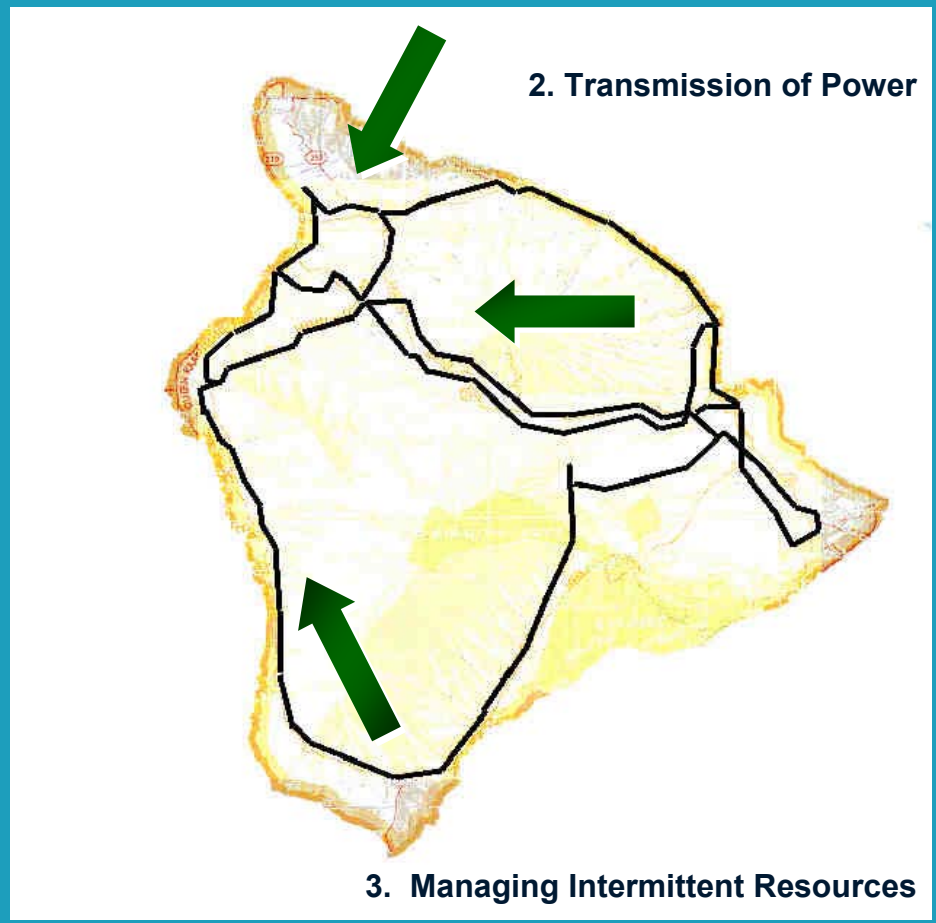
# Why NELHA?

- NELHA Gateway Project opportunity
- Significant existing investment in support infrastructure
- Successful track record in incubating technology companies
- Successful track record in managing, developing and implementing renewable energy pilot projects
- Broad support for distributed energy resource technology development and demonstration
- Recognized by U.S. Department of Energy, industry and academic partners as the “gateway” to distributed generation for Hawaii, Pacific Islands, and Asia.
- Capitalize on positive outreach and community acceptance efforts initiated
- Key component to broadening Hawaii-wide NELHA concept

# NELHA location is ideal for addressing the three energy challenges facing HELCO and Hawaii County

**1. West Hawaii Supply/Demand Imbalance**



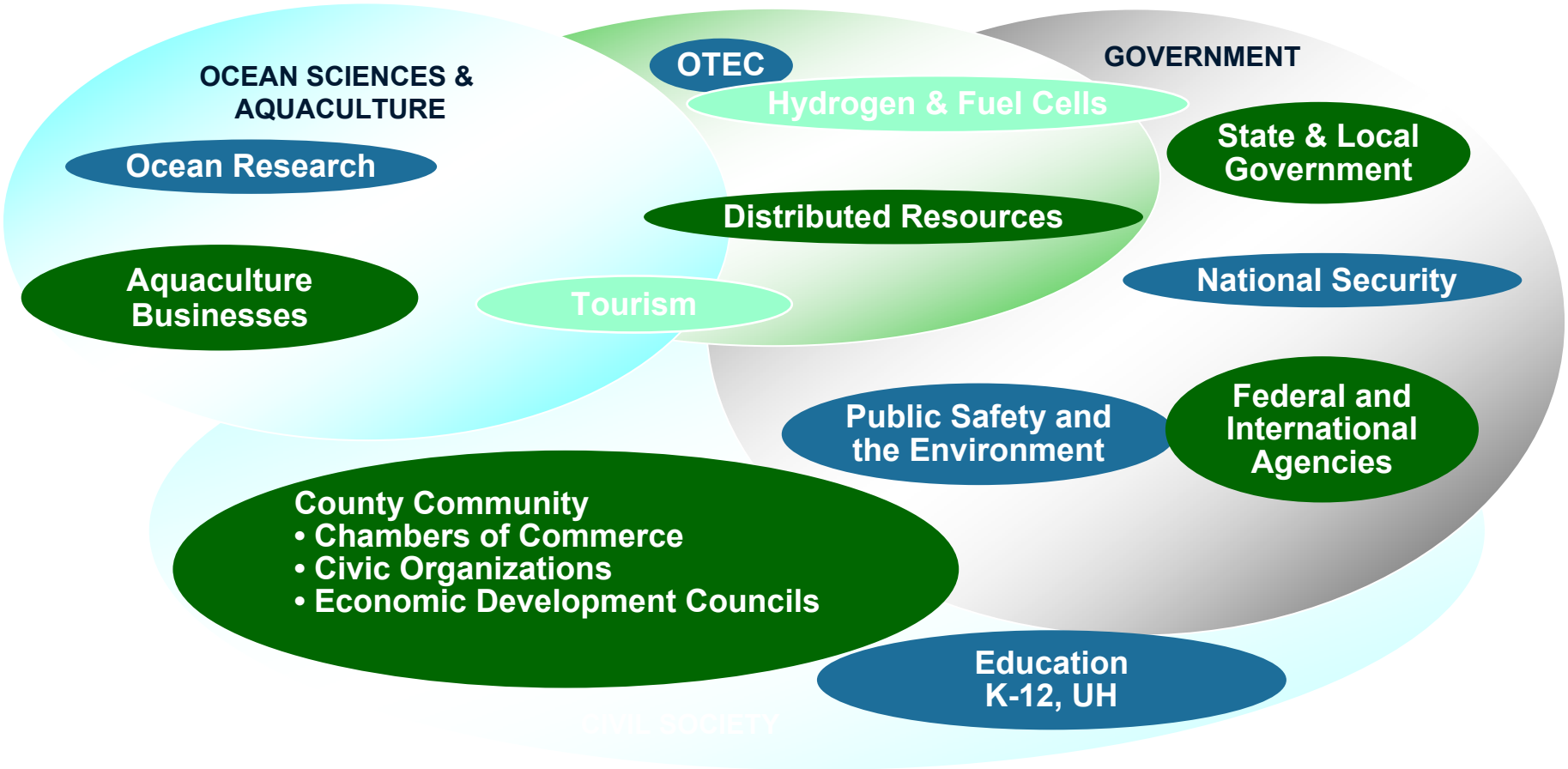
# NELHA Gateway DER Center Supports the DER Strategic Plan

The NELHA Gateway DER Center will support the U.S. Department of Energy and its Distributed Energy Resources Strategic Plan goal of 20% new distributed energy generation capacity by 2010.

# Supporting the National Strategic DER Plan

- Provide centralized site and infrastructure to test DER technologies in a real-world environment.
- Develop outreach activities to accelerate public acceptance of DER technologies.
- Promote industrial partnerships and sponsorship of R&D and testing programs.
- Provide model utility for real-world demonstration of DER technologies (local pool of potential commercial users ).
- Contribution of Hawaii State assets including including those from NELHA; Energy, Resources & Technology Division; and the University of Hawaii.

# The NELHA Distributed Energy Strategy was considered within the broader context



# Partnership Strengthens the NELHA Gateway DER Center

Active collaboration of government, universities, research, and industry will enable:

- Appropriate programmatic guidance
- Mechanisms for sustained funding
- Best available technical assistance
- Community, government, and industry outreach
- Opportunities for collateral joint projects
- Achievement of partners' objectives

# THE NELHA GATEWAY

## Distributed Energy Resources (DER) Center

*Project Partners Include:*

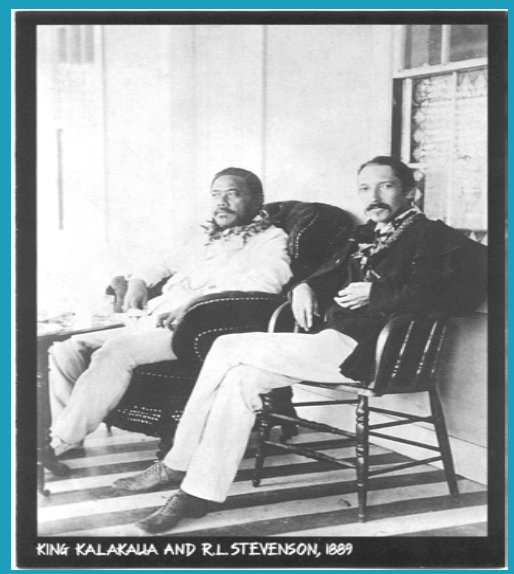
- Natural Energy Laboratory of Hawaii Authority
- U.S. Department of Energy
- Hawaii Department of Business, Economic Development & Tourism (DBEDT)
- Hawaii Natural Energy Institute, University of Hawaii
- New Mexico Tech
- The Kohala Center
- County of Hawaii
- Hawaii Island Economic Development Board
- Utilities
- Energy Companies

# Timetable

| Activity | Start – End |
|---|---|
| Secure funding for Phase I facility | 1999 - 2003 |
| Design and construct Phase I facility | 2002 – 2003 |
| • **Design Completed April 2003** | |
| • **Construction bid & selection in May 2003** | |
| • **Construction commence in June 2003** | |
| • **Construction completion November 2003** | |
| Strengthen DOE partnership | 2001 - 2007 |
| Develop industrial partnerships | 2001 - 2007 |
| Establish state policies to support DER | 2001 - 2007 |
| Secure federal programmatic investments | 2002 - 2007 |
| Independent operations | 2007 …….. |

# ECOLOGICALLY SUSTAINABLE DESIGN

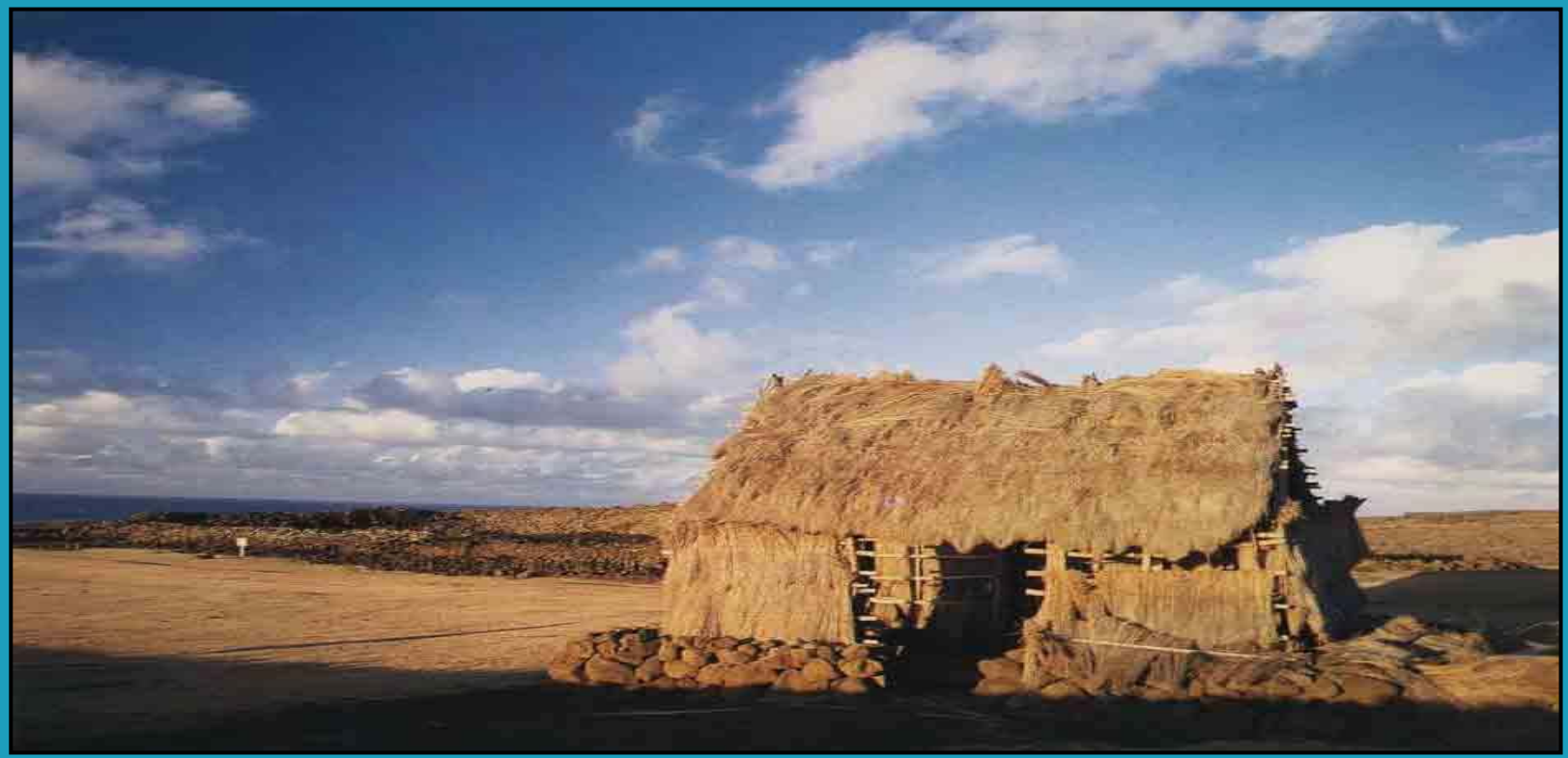
*"TO DO WHAT WE NEED TO DO TODAY WITH AS LITTLE IMPACT AS POSSIBLE ON FUTURE GENERATIONS"*


# The Inspiration

Nature Earth Culture

# Demand Side Management



Long design development time

Many prototypes

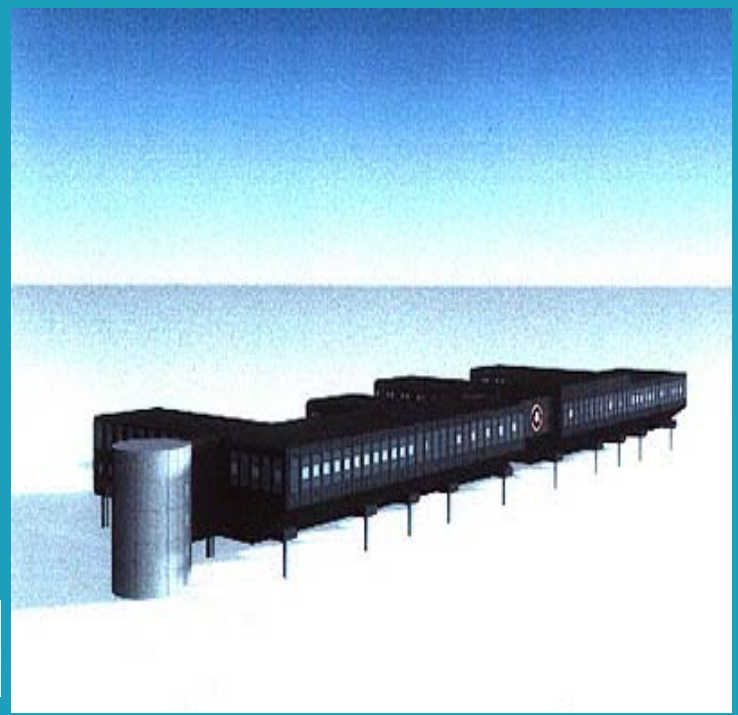
Not scalable

Start again for every climate zone

# NELHA Gateway DER Center Design Dream Team

**FERRARO CHOI**

Ferraro Choi and Associates Ltd
- Architecture
- Sustainable Design
- LEED™ Accreditation 2002



Amundsen-Scott South Pole Station, Antarctica

# NELHA Gateway DER Center Design Dream Team

**Lincolne Scott**

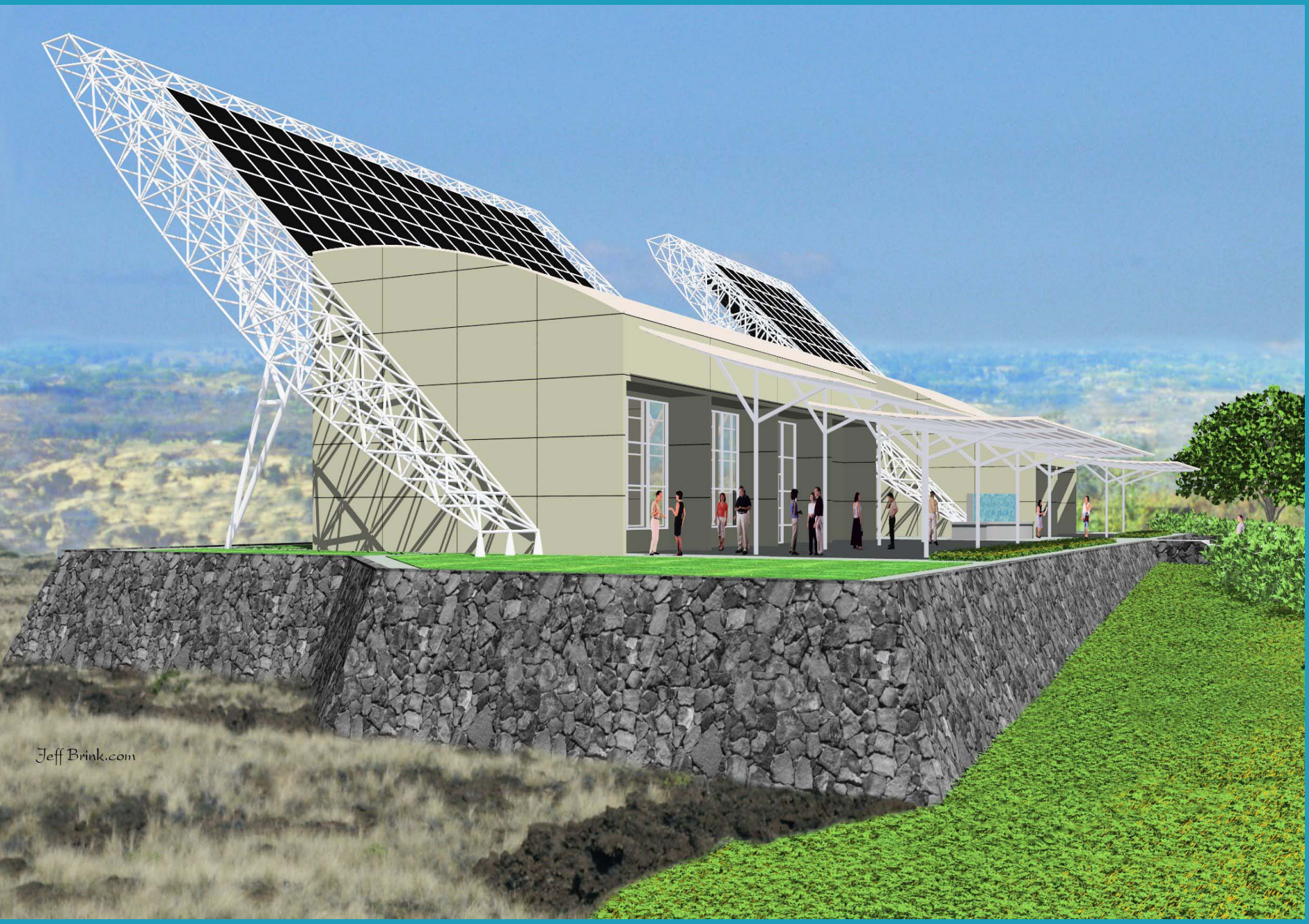
**Relevance, Excellence, Reliability**

Forestry Tasmania Center


# Leadership in Energy & Environmental Design

A leading-edge system for designing, constructing, operating and certifying the world's greenest buildings.

# NELHA GATEWAY DER CENTER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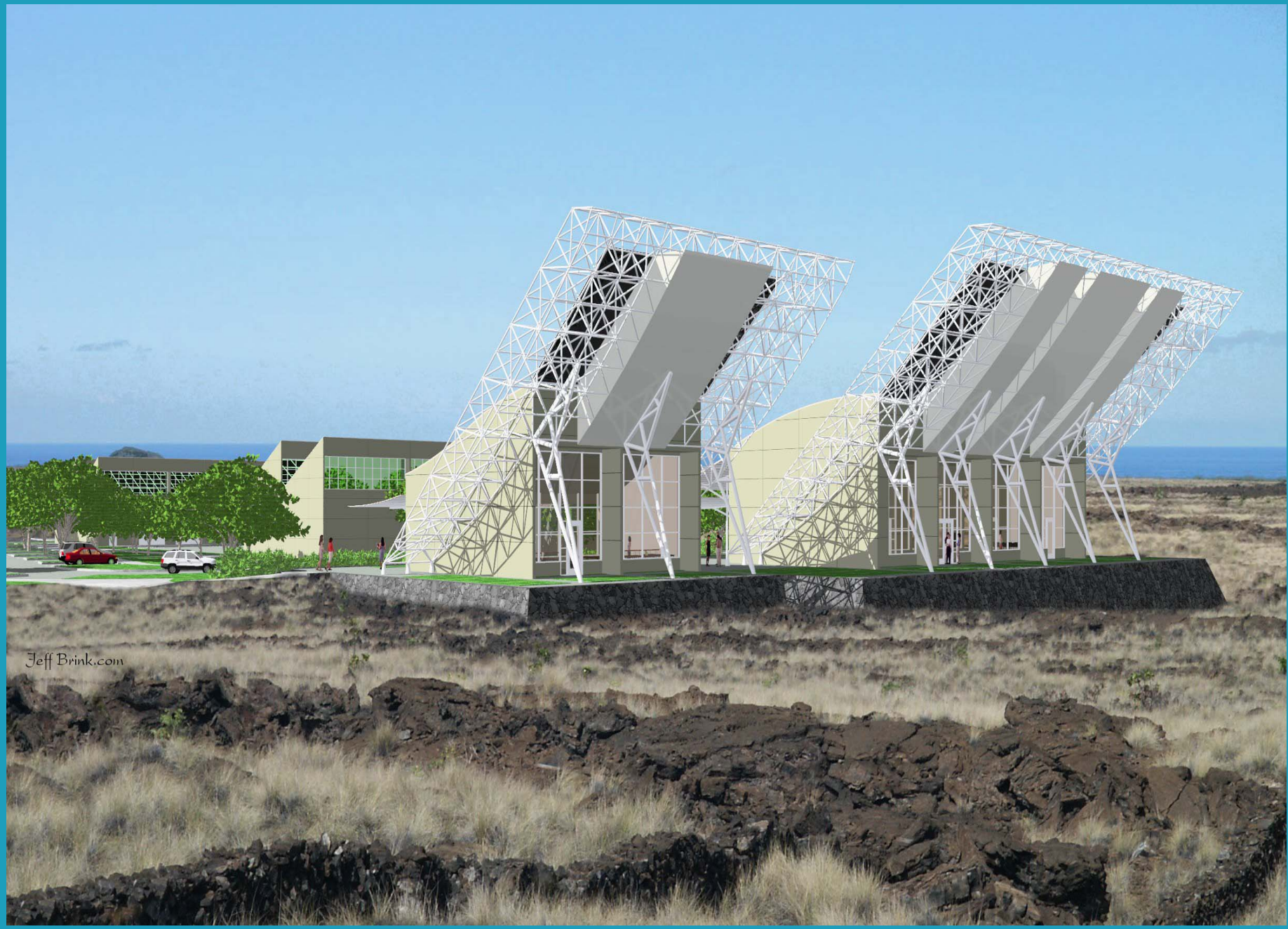
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For more information please visit

www.nelha.org